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ABSTRACT

The need for commercial communications is expected to grow substantially in the future. Whether telephone companies meet most of this demand seems to depend on three major factors: regulatory actions, the development of alternative technology, and the telephone companies themselves. The Federal Communications Commission is considering requiring cable systems to build in two-way communications capability. If this is done, cable companies will want to sell services that take advantage of this capability. The growth of cable television runs some risk of being aborted by new methods of over-the-air broadcasting, said to be capable of increasing the number of TV bandwidth channels and involving far less costly transmitting equipment than existing VHF-UHF stations. The telephone companies are attempting to meet the demand for better data transmission lines. To the extent that they must use their capital to upgrade voice communication lines, instead cable systems with two-way capability may be strong competitors for data transmission business. (Author)

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COMMERCIAL USES OF BROADBAND COMMUNICATIONS

by

Ephraim Kahn

June 1971

A Report Prepared for the
SLOAN COMMISSION ON CABLE COMMUNICATIONS

The opinions expressed herein are the views of the author and do not reflect necessarily the opinions of the members of the Sloan Commission on Cable Communications or of the Alfred P. Sloan Foundation.

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SUMMARY

The need for commercial communications is expected to grow substantially in the future. Whether telephone companies meet most of this demand seems to depend on three major factors: (1) regulatory actions, (2) the development of alternative technology, and (3) the telephone companies themselves.

Regulatory actions: Federal Communications Commission Chairman Dean Burch has told Congress that the FCC is considering requiring CATV systems to build in a response capability. If this is done, the capability for two-way communications will be used. Having paid for it, CATV entrepreneurs will want to sell services that take advantage of the ability of the subscriber (whether in a business place or a home) to originate messages that go back to the CATV headend or to an information storage and retrieval device connected to the headend. This implies a local CATV network with minimal switching--at least enough to identify subscribers to whom messages are sent or from whom they are received. This could be accomplished through multiplexing a CATV channel, thereby enabling a large number of users to transmit and receive over a single TV channel's bandwidth.

Alternative technology: The growth of CATV runs some risk of being aborted by new methods of over-the-air broadcasting. These are said to be capable of greatly increasing the number of TV bandwidth channels without overcrowding the spectrum, and to involve far less costly transmitting equipment than existing VHF-UHF stations require. Some of them are very limited in range--but it is claimed that it would nevertheless be cheaper to put a small, low-power, transmitter every few city blocks than to wire a city.

Assuming that entertainment (including educational) TV is the primary source of income of a CATV entrepreneur, the prospective development and use of new broadcasting methods would very likely be a disincentive to the construction of wired systems. The developer of one of these new broadcast methods is already negotiating with a prospective buyer who plans to use low-power transmitters in a large city to send out a scrambled signal that would be decoded by a rented device attached to the subscriber's TV set.

Telephone companies: Ordinary telephone line facilities are satisfactory for most business communications, and the Bell System is working at remedying deficiencies in its present data-transmission network. By 1975, it is likely that volume users of data transmission will have a wide choice of facilities: improved telephone company service, improved Western Union service, and the microwave networks being established under a recent FCC order. (The first two provide switched subscriber-to-subscriber service; microwave networks contemplate the possible use of CATV installations to link their offices with their customers.)

Telephone companies currently express no interest in conventional trunk-and-branch CATV operations in which transmission goes in one direction only--from the CATV headend to the subscriber's TV set. Besides, the FCC has precluded them from acting as CATV operators in the areas in which they also offer telephone service. If FCC requires CATVs to incorporate two-way communications capability, the telephone companies' stance may change. This does not seem too likely to happen if FCC requires only a rudimentary two-way capability for CATVs. But the telephone companies could be counted on to react strongly and competitively if (or when) CATVs show that they are willing and able to provide services that could be carried out as well (or almost as well) over telephone-type lines.

The Bell System, for example, contemplates eventually far broader use of its Touch-Tone® system than is now available. The Touch-Tone® device itself is a computer access terminal that can operate manually, semi-automatically, or automatically. It can be connected directly to a computer that can answer questions with a mechanical voicing device, or which can actuate a print-out device. These advanced services (as well as other purely telephonic ones, like automatic switching of calls from one telephone to another) are not now generally available. But considering the probable length of time that it will take to build large numbers of new CATV systems capable of providing comparable computer-access functions, it would not be too surprising to find Bell in competition when the CATVs are ready or soon thereafter. Bell has already moved into some low-volume services that depend on telephone access to a computer, primarily credit card verification, where CATVs seem likely to offer greater convenience and lower cost.

INTRODUCTION

Demand for business communications will grow markedly during the decade of the 1970s and thereafter. This demand can be satisfied by broadband communications systems -- cable and microwave, almost certainly multiplexed to increase their capacity to reach different addressees simultaneously. This paper will not try to discuss the complexities of ownership of these broadband facilities. But it appears that, in the absence of a quantum jump in the availability of high quality lines from the Bell System, other telephone companies, or Western Union, one or more new communications suppliers will be needed. For many purposes, existing Bell System or WU lines provide satisfactory service. But large volume transmission of electronic data is far more simply and economically handled by a broadband (or at least a broader band) system.

For business use, two-way communications capability seems essential -- and it is precisely for this reason that cable, as distinguished from over-the-air information dissemination, has an advantage that may be crucial. There are new methods of over-the-air broadcasting under development that can compete with cable in terms of providing broad channels through which information may be pushed in large quantities at high speed. This is fine, as long as the only real consideration is getting the information from a central place to receivers -- either as a group or individually addressed. But if the person who receives the information has to act on it, and himself make a contribution to a return flow of information, cable seems the most economical broadband method.

The costs of the terminals for two-way transmission over cable are less than the costs of transmitters and receivers capable of carrying the quantity of information that takes full advantage of the capacity of the

cable. Obviously, this is of major significance only in connection with the over-all economics of a communications system, and the presumption is that the primary economic justification of a CATV system is to provide entertainment TV, and that the provision of other services is a desirable by-product of cable's great information-carrying capability.

The full information-carrying capacity of a TV channel probably would not be needed for most business-oriented information. A TV channel can carry a moving picture; far less bandwidth is required to transmit a facsimile of a document. If cable communicators make their facilities available only in increments of a full channel, a great deal of capacity will inevitably be wasted in business use. On the other hand, it will take a broad bandwidth to accomodate a number of business users: those interfaced to the same storage and retrieval computer; those requiring simultaneous display of a wide variety of data on a cathode tube screen; or those using facsimile print-out.

The economic impact of foreseeable demand for broadband communications will be great, and both business and non-business users will have to pay for the convenience and capacity they will get. Potentially, business and business-related uses of broadband systems could pay for at least the basic costs of operating these systems. Businessmen who rent TV channels to sell their products would be expected to pay fees at least adequate to defray costs and yield a profit to the CATV. Users of channels for other commercial purposes would do the same. And since it would be to the advantage of the CATV entrepreneur to persuade as many people as possible to subscribe to cable service, because he could then charge more for those services in which rates are linked to the size of potential audience, the cable operator

could well elect to use the availability of high-quality TV reception at low (or even no) cost as an inducement to subscribe.

Profits would then come from the non-entertainment uses that the home owner or businessman would make of the cable's communication ability, whether supplied by the cable entrepreneur himself or by others who would lease his facilities to carry on their businesses. This does not preclude the possibility that Pay-TV will develop as well.

At a minimum, revenues from use of broadband cable channels for non-entertainment uses should help directly to put into practice some of the desirable principles set forth in the 1968 report of the President's Task Force on Communications Policy, and make it easier for the others to be realized.

As long as telephone companies are committed to a basic cost-per-call system of computing basic charges, an important competitive opportunity will be available to cable systems: renting a channel (or a fraction of a channel) to volume users. This evidently could be done at a cost significantly lower than the charge made by telephone companies for open lines.

A dedicated signal path is implicit in automatic checking of credit verification devices, for example. Such a path is also desirable for the volume user of data communications. The foreseeable cost advantage to two-way cable communications may be enhanced if the Bell System generally adopts a policy of imposing a surcharge on computer-connected "Information System Access Lines." This ISAL tariff would require almost all companies that have telephone lines going to computers to pay an additional fee for the privilege of computer access. Computer users protested the imposition of a surcharge when hearings on its ISAL tariff proposal were held in Illinois.

To the extent that telephone company charges for computer access exceed those made by a CATV system, users of computers through distant terminals will have an incentive to use the CATV's facilities. Although the Illinois application was withdrawn at the request of the local regulatory agency, ISAL tariff applications are currently pending in Florida, Georgia, and the areas served by Cincinnati Bell.

Today, demand for data transmission capacity is not being adequately met by existing suppliers of communications lines. Complaints have frequently been made that the information-carrying capacity of existing telephone-type lines is not great enough to permit users of data-processing equipment to take full advantage of the capabilities of today's computers. Complaints are also made that existing service is too costly, service and maintenance inadequate, and that the public utilities offering data transmission lines to users do not seem to care about users' problems.

Present common carriers of communications are, of course, aware of these complaints and criticisms. The Bell System, for example, plans to have a separate network for digital data transmission installed by the middle of this decade. This new network will serve 50 to 60 major U.S. cities. Western Union also has a data network coming up. It should also be noted that the capital needs of telephone companies are great -- Bell estimated $100 billion by 1980 in a 1968 forecast -- and they are hard pressed just to meet growth in telephone demand and upgrade their existing systems. If this consumes all of the money available to them, then CATV entrepreneurs should be able to develop the commercial services that they are able to provide relatively free of immediate competitive pressures. Eventually, it must be assumed that telephone companies will compete in any area that requires two-way switched communications. Faced with this prospect, it seems possible that some CATV operators could elect (regulation permitting) to install only rudimentary two-way communications capability.

Still others might opt to use the telephone company's lines to provide a channel from the subscriber to the CATV headend.

New cable companies conceivably could be in an advantageous situation to attract the capital they will require. For one thing, installation of local cable systems will not be inordinately costly. This will present potential investors with an opportunity to own a portion of a system instead of using the same amount to buy an insignificant fraction of Bell. For another, the investors in the new system will not be in the position of having to service large quantities of outstanding senior securities, or of seeing their equity diluted through bond conversions. To the extent that "getting in on the ground floor" is an investment incentive, cable companies will be able to offer it.

Growing demand for broadband communications will very likely be satisfied at first by microwave radio and telephone company facilities for long distances, and by cable over shorter distances. These present the lowest costs for digital data, the prime business use. At present, the telephone companies and Western Union offer the widest range of switched facilities. Existing cable installations typically offer primarily entertainment TV on a one-way basis to individual subscribers. Eventually, they will become more sophisticated and the public policy issues involved in permitting the existence of what would essentially be a second national telecommunications network for individual subscribers (business and non-business) will have to be faced.

CURRENT COMMERCIAL CAPABILITIES

While some new cable systems are being built with two-way communications capability, at least one company has devised a method of adapting existing coaxial cable TV networks for two-way communication. This company, Subscription Television, Inc., South Pasadena, California, will be used as an example. There are competitors--Jerrold Electronics and Fairchild Camera and Instrument to name only two--offering to provide comparable services and devices.

Success of two-way cable communication depends in large measures on the FCC. Chairman Burch has told Congress that the FCC is considering requiring two-way capability in CATV systems. If this is done, then cable entrepreneurs can be counted on to sell the services it will make possible. If FCC fails to require two-way capability, then the growth of two-way systems will depend in part on the success (that is, profitability) of the few systems that are already providing this feature to their subscribers.

The cost of two-way capability is relatively modest. The NCTA has estimated that it would cost about $180 to $200 per mile to include a pair of twisted wires (usable on a time-sharing or party-line basis by all subscribers) when a new system is built. This would provide a 4 kHz message channel. Adding this capability to an existing system would cost between $300 and $400 a mile. Additional costs would be incurred for subscribers' terminal devices and for switching equipment at the CATV headend. A broader channel-- 1 mHz--could be included in the two-way capability. This would be adequate for Picturephone-type transmissions. No estimates of cost for including this are available.

The STV system "has been specially designed to transmit and receive digital information over today's existing coaxial cable networks," the company says. It requires 5 mc bandwidth--2.5 mc in the mid-band of the VHF spectrum going out to the subscriber and 2.5 mc in the sub-channel region below channel 2 returning to the STV interface equipment. Maximum capacity of the system is 500,000 bits per second to and from all subscribers, but within that ceiling it is infinitely flexible.

The STV system is controlled by a central processor, which not only receives and transmits information but acts as a traffic control device so that information will not be put into the system when it is overcrowded. This central processor interfaces with the CATV transmitter. Each subscriber on that system has an STV service selector, which can communicate with the central processor. The central processor can send messages to any subscriber individually, and identifies the source of information any subscriber sends back. Coded signals can be sent at regular intervals to all subscribers to find out what services offered by the system are being used, whether purchases have been made from a shop-at-home channel, whether pay-TV is being watched, etc. Since it takes only 40 bits for the central processor to make such a query, and 40 bits for the subscriber to reply, a single transmit-reply cycle requires only 160 microseconds. This means that each of 10,000 subscribers could be queried once every 1.6 seconds. Something like this would appear to be very well adapted to credit card checking, where the in-store terminal would be in an 'open' or 'no response' position at all times other than when a card is placed in the device for reading. The flexibility of the STV system enables it to handle high density data at high speed to a limited number of subscribers or low density data at lower

speed to a large number. This implies, too, that high density data could be transmitted at adequate speeds during times when the system would otherwise be underutilized.

STV estimates that a single central processor can serve a maximum of 50,000 subscribers. It notes, however, that smaller 'slaved' processors adequate for about 10,000 subscribers can be introduced into the lines to act as store-and-forward modules. The company also says that a number of separate, smaller CATV systems could share a central processor--five systems of 10,000 subscribers each, for example. Connecting lines between the central processor and the CATV system "can be coax or telephone lines depending on the distance and other factors."

STV--obviously convinced of the desirability of its technology--notes that its system is competitive with "the more familiar types of communications systems." It combines the bandwidth of coaxial cable and the speed and flexibility of a digital transmission system. "In this way, the CATV operator can offer a lower cost per message for non-video services and still maintain his video services that cannot be duplicated by conventional methods."

DATA TRANSMISSION

Estimates of the growth in demand for non-government pure analog digital data transmission for business (not residential) users have been made in connection with applications to have the Federal Communications Commission establish a specialized data transmission network. Those given below were submitted by Data Transmission Co. (DATRAN) to the FCC as part of its application. Volume of voice, video, telemetry, telegraph, and teletypewriter traffic is not estimated.

It should be borne in mind that DATRAN at the time was 'selling' the FCC on permitting such a network to be established. But even if the estimates were to be discounted by 50 percent as an allowance for euphoric optimism, the projected growth would be impressive.

DATRAN's estimates cover seven industries, not all of which will be noted in detail here. Over-all, in 1970 these industries engaged in 14 billion transactions carried out through 3.7 billion data calls. By 1974, there will be 50 billion transactions that will generate 12 billion data calls. In 1980, these industries are expected to make 250 billion transactions through 32 billion calls. This would represent an increase of 750 percent in the number of calls over the decade, and cumulative growth of 1,650 percent in the annual volume of transactions.

The federal government is already the largest user of data machines. No estimate has been made here of the extent to which governmental use of data transmission will grow, but it is likely to be considerable. Much of the government's transmitted data is classified, and estimates of this volume are not currently available. The total government use of data transmission is believed to exceed by far the volume generated by the

civilian economy. It should be noted, however, that (according to Daniel Lieberman of Sylvania Electric Products, Inc.) "the largest military communication system--Autodin...has a theoretical throughput of about 250,000 bits/sec. or only 1,100 the handling capacity of a CATV system" with an information spectrum of 5 to 270 MHz.

Demand for data transmission facilities will also grow as a result of a decision by the Federal Reserve Board to permit bank holding companies to undertake--for businesses not related to the holding company--"storing and processing other banking, financial, or related economic data, such as performing payroll, accounts receivable or payable, or billing services." Linking the bank computers that do the data processing with the customers who are having this work done could well be a function of local CATV systems.

SECURITIES INDUSTRY

At present, the securities industry is a heavy user of data telecommunications, and it will undoubtedly continue to be. The industry is spread all over the country, but most transactions take place in New York City.

Typically, the customer of a brokerage house wants fast action: if he places an order to buy, he wants confirmation of execution in a matter of minutes. The seller is similarly impatient. Because of brevity of content, sales and purchase orders, requests for quotations, size of the market in individual securities, and the like can be handled adequately with the facilities now made available by the Bell and other telephone systems.

In the future, this may not be true. Although stock quotations are now available in many brokerage offices through visual display machines (Quotron, for example), there may well come a time when customers want more.

With a two-way broadband communications system, customers could obtain research data, information on the status of their accounts, and make other one-to-one inquiries. Answers would be displayed on TV-type screens or as a hard-copy facsimile of the material transmitted by the broker.

If a switched broadband system comes into being, this could presage a major change in the ways brokerages do business with their customers. At present, both institutions and non-institutional customers generally place orders by telephone. The broker supplies securities research data

without extra charge, most often on a printed sheet that is available to all customers and frequently to others as well. Research is given away to the general public to build new business and to keep old customers.

With a fully switched broadband system, customers could communicate with any broker and obtain the fruits of his research. To be sure, the same computer that supplied the data could be programmed to note the calling code of the person making the request and this could be translated into a name and address for future sales efforts.

But such inquiries would take up computer time and they could well be more costly to brokers than mailing a prospect some sheets of paper. Furthermore, since this information would be accessible to anyone willing to expend about as much energy (and perhaps less money) as it now takes to make a telephone call, many more investors (and the idly curious) might choose to shop the research departments of several brokerages before making a purchase or a sale.

If the inquiry load becomes too heavy, this could impel brokers to either (1) limit access to their research to their existing customers, which they might be reluctant to do, or (2) impose a fee for research services -- in which case they might market them on a fee-for-service basis, giving their customers either a preferential price or a full rebate when they undertake a transaction through the firm, based on its research.

It goes without saying that a fully-switched national broadband TV-linked system will have additional effects on the brokerage business. If customers are able to talk to, and see, their account representatives by wire, the need for large numbers of branch offices will be smaller. Although it might not pay to install TV capability just so the customer can see his account executive, the existence of TV communication would make it possible to display documents or send facsimile material. Some brokerage houses

might find it more desirable to locate near the exchanges (or elsewhere) and save the cost of branch office operations.

By concentrating their most effective customers' men in a single location -- and expecting each one to handle a heavy load -- they could well save enough to absorb the cost of communications and still wind up the year with higher profits. Payments and receipts, by the time this develops, may well be handled electronically so there would be little or no need to have branch offices where customers can make payments or which can mail checks to customers.

Indeed, in the fairly distant future it is easy to conceive of a fully computerized stock market in which sale and buy orders are placed electronically direct by the customer, and matched by the stock exchange computer. Capacity of a broadband system would be adequate to support such a set-up, and growth in the number of investors may demand it.

Increasing numbers of Americans have been making stock market transactions in the course of the past 30 years, and more and more people are becoming experienced and sophisticated in their approach to making money. With ample information instantly available, and low-cost communication devices capable of making transactions on an on-line basis, it would seem reasonable to expect that the number of alert, astute investors or speculators will continue to increase, and that they will be willing and able to shift funds at relatively low cost from one type of investment to another in accordance with their short-term plans. Broad and easy access to information on which to base transactions could well make 'instant arbitrage' a national pastime -- if it didn't eliminate the arbitrageur entirely by making the information he now has available to many more people.

HEALTH BUSINESS

The health business, which now uses data transmission facilities on a very modest scale, is likely to become a larger user in the course of this decade. Aside from the potential broadband communications uses that exist in long-distance visual and computer-aided diagnosis, it seems probable that health insurance companies will continue to use data transmission in the course of processing individuals' and hospitals' claims, in keeping accounts and records. As data networks expand, the volume of pharmacy, physician, and hospital accounting should grow, and patient data (results of tests, etc.) can be stored in a computer for future reference. With the development of adequate programs, computers connected to pick-ups on the patient should be able to carry out in-hospital patient monitoring on a sizable scale, as well as billing patients and recording collections. (Note: the use of cable in the health business has been dealt with in detail by Konrad Kalba in a paper prepared for the Sloan Commission; this paper was not available to me, but it seemed appropriate to note briefly some of the medically-related potential commercial uses although this is almost certainly duplicative.)

BANKS

Banks and other financial institutions are already significant users of data processing, and their demands will grow considerably in the years to come. Their foreseeable communications needs are great, and two new laws -- the 1970 amendments to the Bank Holding Company Act and the Fair Credit Reporting Act -- hold forth the promise that their actual requirements will be even bigger. A strong spur to the expansion of electronic transfers is the adoption by the Federal Reserve Board of a policy statement stressing that it is "a matter of urgency" to set up a nationwide, direct, fast and economical system to transfer funds and settle balances; to reduce the volume of items banks must handle; expanding at least some Federal Reserve Bank facilities "to include high speed tape transmission, and computer-to-computer communications";and to reduce the "float," or amount of money in transit. (The impact of the FCRA is discussed more fully later, under "Facsimile.")

K.A. Randall, former chairman of the Federal Deposit Insurance Corporation, now chairman of a large bank holding company, pointed out in 1970 while still a federal banking regulator that "technology particularly is going to force institutions to be generally larger in size." He added that with this, there will come a reduction in the number of financial institutions in the U.S., suggesting that there would be a shrinkage from a total of around 22,000 financial institutions of all types "maybe to around 8,000 in another 20 years." This would be accompanied, he said, "very likely" by "branching in some form in every state."

Bankers are likely to be receptive to new ways of doing business. They have been hearing about the 'checkless society' for years, and they are expansion-minded. Governor William W. Sherrill of the Federal Reserve, for example, says that the time has come for bankers to reorient their concept of banking, and to recognize that banking's "function no longer is predominantly lending but must become a concept of greatly expanded financial service to its customer."

Governor Sherrill foresees "a time when financial advice, bookkeeping, budgeting, and financial management information provided to the customer may be much more important in the customer's eyes" than the funds that banks make available. And, he adds, these services would probably be "much more profitable" to banks.

Bankers are aware of the ever-growing flood of paperwork that will confront them. Early in May, 1971, the Monetary and Payments Committee of the American Bankers Association reported that banks must start at once to seek the advantage of 'paperless' debiting and crediting. This is significant not only because it takes a coherent look at the problems of the future, but because the men on the committee that made the report all are high-level, policy-making bankers -- the only people that can push the institutions they work for in the direction of anticipating technological change and getting ready for it in time.

The ABA's MAPS study does not envisage a sudden change to a magical 'checkless society' -- a concept that has been around for some years but which has not always been fully analyzed. The bank group took a practical approach: it looked at the growth that has taken place in check handling in recent years, projected it into the future, and found that by 1980 banks may be processing 43 billion checks a year. Since this aspect of banking

is labor-intensive, this raises a number of problems. One is that suppliers of automated check-processing machinery do not envisage major technical improvements in equipment over the current decade. This implies that more people will have to be hired to process the additional checks -- and it would not be reasonable to anticipate that their wages will be low. As a further spur to movement toward paperless trnasfers, projections of the availability of clerical manpower during the 1970-1980 period indicate that demand for clerical workers will outstrip supply, and that the clerical labor pool will be in deficit for at least half of the decade.

In the absence of widespread adoption of cost-cutting banking methods, costs to customers would rise -- and, obviously, in some highly competitive banking markets not all of these added costs could be passed on to the customers.

The MAPS committee did not foresee the end of the check as it now exists. In fact, its chairman, Richard P. Cooley, president of The Wells Fargo Bank, N.A., San Francisco, states flatly that "paper checks will be around for as long as we can envision," and that "banking can continue to operate efficiently with a paper check system."

But banks are already taking steps to cut down the volume of checks they must handle. Many banks have arranged for pre-authorization of certain payments that must be made regularly. This takes the form of customer authorization of monthly withdrawals to pay such debts as mortgage loans or insurance premiums. Some creditors give customers who pre-authorize these payments a discount. To the extent banks succeed in making conventional transfers more efficient, their incentive to use electronic transfers broadly will diminish.

Less common, but on the increase, in the multiple check. When a multiple check is used, a customer makes a list of his creditors and the amount each is owed, and makes out a single check for the total. The check goes to the bank, which parcels out the money to the individual creditors by adding the funds to the creditor's account in the bank. Growth of multiple checks would also lessen the urgency of conversion to electronic transfers for individual accounts.

Under the 1970 amendments to the Bank Holding Company Act, the Federal Reserve Board regulates both bank holding companies that own a single bank and those that own more than one bank. The amendments were passed by Congress to close a loophole in prior bank law which permitted one-bank holding companies to operate without federal regulation of their non-banking subsidiaries and affiliates. The FRB, at that time, strictly regulated multi-bank holding companies, not one-bank holding companies.

When Congress passed the 1970 law, it was made clear that all types of holding companies were to be subjected to the same regulation, and that the FRB should be less strict than it had been in the past.

Under the Board's proposed rules for non-banking activities by bank holding company subsidiaries, it seems clear that bank ownership of a broadband communications distribution system would now be forbidden. But it must be remembered that Congress wrote a flexible law enabling banks to offer broad financially-related services to their customers, so that a ruling that CATV system ownership is a permissible activity is not inconceivable in the distant future.

The overall impact of the law, from the viewpoint of the cable communicator, is that it will markedly increase the need for communications within the banks commonly owned by a holding company, and within the family of subsidiaries directed by the holding company.

Of considerable significance in this connection is the fact that the 1970 law puts no geographic limitations on the operations of the non-banking but financially related subsidiaries of a bank holding company. As well it might, this has perturbed spokesmen for some of the nation's smaller independent banks.

Banks themselves are bound by state law with respect to branching. Some states (Illinois is an outstanding example) permit no branching at all. Others (Maryland, for example) permit limited branch banking. Still others (California leaps to mind) have liberal rules that have led to the development of state-wide banking operations.

Since multi-bank holding companies are now subject to the same regulation as one-bank holding companies, some banks are making efforts to expand their banking markets by establishing new banks, as well as by acquiring existing banks. As large or growing bank holding companies acquire control of others -- some quite distant from their home territories -- they will want and need operating data from them on a daily basis. This will involve the use of data transmission--either over telephone, WU, or microwave circuits. If transmission is made over microwave, a local CATV could serve as the carrier-to-bank link.

The demand for communications between holding companies and the banks they own or control will be more intense than most people expect. The Assistant Attorney General for Antitrust, Richard W. McLaren, recently made it clear in a memorandum to the Federal Reserve that the parent company in a bank holding company system can exercise considerably more direct influence on the banking and pricing decisions of each of the banks it owns or controls than had earlier been thought permissible.

Bank holding company subsidiaries may engage in activities "so closely related to banking or managing and controlling banks as to be a proper incident thereto." Before engaging in these activities, the Federal Reserve Board must approve them. So far, it has proposed a list of such activities that normally will not be forbidden to bank holding company subsidiaries. The Board contemplates adding to the list.

In considering the activities that bank subsidiaries may engage in, the Board must determine whether permitting these activities would yield increased competition, greater public convenience, or gains in efficiency that would overbalance any possible adverse effects like decreased or unfair competition, undue concentration of resources, conflicts of interest, or unsound banking practices. The Justice Department has urged the FRB to apply a liberal entry policy to banks as they seek to enter other financial markets. The Antitrust Division has made it clear that it prefers to see banks entering new markets by starting new competitors rather than by acquiring existing firms. This also implies that communications needs will be greater.

Another aspect of the 1970 law that promises to be important to the development of demand for bank communications is the requirement that some conglomerate corporations which now own banks make a choice between continuing their present non-banking businesses and engaging solely in banking. As a practical matter, this will mean that all conglomerate-owned banks will have to be sold by 1981. The bank holding companies that were originally organized to hold a single bank -- and to benefit from the exemption from federal regulation of non-banking activities that then existed -- will undoubtedly be in the market for these institutions.

Within the banking community, there is broad recognition (though far from universal approbation) of a trend to bigness. In part this is because banks have to be bigger to be economically viable today. This is reflected in persistent moves to liberalize the branching laws in states that are now highly restrictive.

Many smaller banks have refrained from installing their own data processing equipment because they are too small to justify it economically and do not believe that they can sell enough outside data-processing services to make data processing a paying business. Virtually all larger banks have their own data processing equipment, either owned directly or owned and operated through a subsidiary. Still others use independent data processors.

With more liberal branching and a tendency for banks to grow larger and to affiliate with holding companies, the need for communication among the bank's entities will expand. Today, many banks have their computers located at the main office. It works for the main office and the branches. But the means of getting data from a branch to the computer are relatively primitive. Within a city, a truck picks up a day's transactions from a branch or a subsidiary and takes them to the main office for processing. This is subject to delay, documents may be lost, and is relatively costly. There is little on-line interconnection among branch banks and a central computer, so that transactions are simultaneously handled at a remote location and recorded by the central computer. In some banks, branch transactions are batched and sent to the computer several times a day by data-phone.

Many banks already have limited branch communication with their central computer. Typically, this permits a teller to use a Touch-Tone ® telephone to ascertain a customer's current balance.

As broadband communications become increasingly available, it will become easier and possibly less costly for banks to install on-line intercommunications. Even if a bank with several branches, or a holding company with a number of banks, does not want to operate this kind of a system, it could well choose to use a channel (or fraction) of an existing CATV network to transmit its data to the computer at a time of day when entertainment use is minimal. Unlike stock brokerages, banks do not now depend on immediate transmission of data. They can easily move their traffic at off-peak hours, since the computer will in any case start the next business day fully up-to-date. This delay will not be tolerable when the "checkless society" comes into being, although a continuing lag in transfers of funds is not invariably a disadvantage.

Although the checkless society may be a long way off, it is far closer for financial institutions than for the general public. Banks and other financial institutions trust each other. They will accept electronic confirmation of transfers of funds from another financial institution. But they require a piece of paper when they deal with their everyday customers. In the absence of a facsimile system, they would not get a signed document on an electronic funds transfer by one individual for the account of another.

The fear of crime will in certain respects be a spur to the development of electronic transfers. Small merchants, for example, would welcome the idea of general electronic transfers triggered by credit cards since it would free them from the loss of cash they suffer when held up and from the possibility of personal injury at the hands of the hold-up man as well.

This additional security could well be worth money to the merchant -- the money that would go to pay for the communications system needed for the credit card--or 'currency card'--that buyers will use when electronic transfers are widespread.

Some resistance is likely from the general public -- in part because electronic transfers mean instant reduction of the bank account. Clearly, some method will have to be found to combine 'cash' and 'credit' authorizations in a single card. This could be done by having the merchant press a 'cash' button or a 'credit' button on his in-store verification and authorization terminal. Conceivably, when a purchase is made on a 30-day credit account, the transfer system computer could store the debit and forward it for action at the proper time.

A system might even be worked out to accomodate 'slow paying' customers. This might involve having the computer query the customer through his home communications console at the time the payment falls due. The customer then could elect to endanger his credit rating by refusing payment, or to pay all or a part of the amount due. Some stores, of course, would choose to refrain from giving credit and sell only on a cash basis.

A significant step toward larger-scale interbank electronic transfers has been made by the New York Clearing House, whose Clearing House Interbank Payments System (CHIPS) is currently handling between $15 billion and $20 billion a week. The CHIPS set-up handles about 15,000 transactions weekly on behalf of about 4,000 accounts that foreign banks have in eight large New York commercial banks.

The system is based on a large Burroughs computer at the Clearing House, with 42 smaller Burroughs terminal computers at the banks. The terminal computers are linked to the main one by two leased telephone lines; each bank has an additional dialed line that can be used if the leased lines are not available. The computers store payment messages and release them as they are authorized. Their memory capacity is sufficient to enable the banks to keep workload fluctuations from being too wide.

CHIPS saves the banks time and money by dispensing with checks for each transaction and the cumbersome settlement procedure they involve. But a hard copy is made at both ends of each link so that the accuracy of transmission can be verified. With the CHIPS system, a computer terminal operator enters a payment order, for example, upon receipt of a cable from abroad. Each bank--and each account of foreign banks--has a code number. The appropriate numbers are sent to the computer, plus the amount of the transaction. The computer adds control numbers to the message, and returns a hard-copy printout of the data to the sending terminal. When this hard copy is approved by an officer of the bank that originated the transfer, the terminal operator releases the message and the computer automatically sends it to the proper destination, where the terminal prints it. The computer's codes are standard; all banks are familiar with them, and the use of a bank's code in a message results in a full printout of its account name and other relevant data.

At the end of the business day, the main computer balances all transactions and prints reports that show the status of each participating bank with respect to the accounts it handles. Each of these banks gets full daily reports from the computer. The CHIPS system does not yet handle all interbank payments in New York, but its operators anticipate that its workload will speedily climb to 5,000 a day, and that eventually it will eliminate about 40,000 payment checks a week. Banks in Southern California have inaugurated an even larger electronic transfer system.

The executive vice president of the New York Clearing House Association, John F. Lee, believes that bigger networks and greater geographic spread "will have to evolve...as costs, capacity and needs are evaluated. The

system has been developed", he notes, "and we have the computer equipment and programs available to make expansion, in terms of single or multiple systems, entirely feasible."

The Federal Reserve Board is concerned about the future adequacy of its electronic funds transfer network. At present, this system is based on telephone lines which handle about 150 words per minute. In the foreseeable future, the FRB system will be upgraded through equipment changes to handle at least 10 times as much. Currently, the Board apparently sees no need to investigate the potential of broadband systems--but it may do so in the future. It seems clear, however, that FRB technicians believe that by the time demand would be ready to overwhelm the present system, Bell will have more capacity available.

The Board is developing a computer model that simulates the nation's payments mechanism. It will portray the flow of checks and other cash items within and among the 36 cities (soon to be 37) where the Federal Reserve has offices. The model will help the Board to determine the future potential of the present check system, and--in the light of technological developments--to evaluate alternatives.

FACSIMILE

Facsimile transmission is one area in which the advantages of broadband can not be seriously disputed. But even here, it is not necessary to use a full TV channel-width to obtain satisfactory definition on the final copy. Facsimile transmission over the ordinary telephone line is slow--between 4 and 6 minutes per page. This may be reduced as data compression techniques are applied to facsimile, and as the telephone company makes available wider lines that will be able to exploit this capability.

The cost of high-grade, speedy facsimile machines--and the unavailability of wider-band lines to accomodate this traffic--have interacted to inhibit the widespread use of facsimile by the public.

It has been suggested that wider-band networks be used to supplement--and eventually to supplant--the mails as we know them today as a carrier of information. If current growth rates persist, the U.S. Postal Service will have to handle more than 108 billion pieces of mail (excluding checks) in 1980.

A proposal to substitute facsimile via satellites for inter-city mail distribution has been filed with the FCC by General Electric. Local distribution would be handled by CATV systems, at an eventual cost of about 10 cents per 150 words, with delivery to terminals equipped with alpha-numeric typing devices. William B. Gross, of GE, envisages three phases in the development of a facsimile-printout mail system. In the first, Bell System long lines handle intercity traffic and deliver to the local CATV. In the second, long distance traffic moves by microwave. The third phase encompasses both satellite and microwave long-distance transmission. Costs would decrease as the mail system matures; at first it would very likely be used only for business letters that would otherwise go special delivery,

via airmail. The existence of such a mail transfer system would be particularly helpful when next-day delivery of business mail is sought, since this traffic could move through the system at times when other demand is slack.

Long distance broadband transmission (using the equivalent of 10 or 12 telephone lines) is already in use within the U.S. government, where Long Distance Xerox moves facsimiles of documents at the rate of six to eight pages per minute. The State Department, in addition to using LDX for traffic within the U.S., uses Optical Character Recognition systems to transmit overseas. This system involves the use of an OCR reader interfaced to the Department's communications computer, which automatically sends communications to the proper destination. This bypasses manual tape-punching completely, and enables information to be delivered at improved speed and accuracy even to places with only a telegraphic-grade communications system.

It should also be noted that there are a number of alternatives to facsimile transmission that provide a hard copy at speeds satisfactory for most business purposes, certainly faster than common carrier printed messages, including Telex. The IBM magnetic tape Selectric typewriter, for example, transmits at 180 words a minute over telephone lines and produces a second "original"--or a duplicate magnetic tape--at the receiving end. This could well be satisfactory to many users who do not have the volume to justify an OCR system, or who wish to take advantage of some of the machine's other capabilities, such as typing with a justified right-hand margin.

Very recently, a device was demonstrated that makes it possible to use an ordinary telephone line to transmit documents while simultaneously using the line to carry a conversation. At present, the machine takes several minutes to transmit a page. If it can be speeded up, this could present a practical alternative to broadband facsimile transmission for many users.

The Fair Credit Reporting Act should be a spur to the development of facsimile transmission, since all grantors of credit must--in specified circumstances--provide persons who have been denied employment or credit, or for whom the cost of credit has been increased on the basis of a consumer credit report, certain data in written form.

The FCRA applies both to "consumer reporting agencies" (credit bureaus, some banks, etc.) and to users of consumer credit reports. Many banks have engaged for years in acting as consumer credit reporting agencies. Others have not, and they want to avoid having to comply with the burdensome record-keeping and disclosure requirements that apply to consumer reporting agencies.

To avoid becoming consumer reporting agencies under this law, banks will have to be particularly careful when they are asked by a merchant whether they will extend credit on a transaction, according to the American Bankers Association. If the bank refuses credit--or increases its cost--on the basis of a consumer credit report, the dealer must disclose to the customer the name and address of the bank, and the bank in turn must give the customer the name and address of the agency that made the report.

It has been suggested by bank lawyers that pre-printed forms be provided to merchants for use in making these disclosures. But it has also been pointed out that while the required data could be dictated by the bank to the merchant and the form could be filled out while the customer is still at the merchant's place of business, the bank would have no assurance that the merchant invariably complied with the law. Facsimile transmission of the required data to the merchant would provide an adequate record of compliance. It goes without saying that credit bureaus would also be users of such a system. Compliance with FCRA could be particularly important

to local CATV systems, since they will have broadcast service available on a local basis. If facsimile is used to prove compliance with this law, CATV systems would be logical carriers.

CREDIT CARDS

Credit card authorization is expected to be a major new business use for data communications, particularly as low-cost card readers become available. The American Bankers Association Bank Card Standardization Task Force has urged the credit card industry to adopt a system of magnetic stripe encoding to make credit cards machine-readable. It proposes that the magnetic stripes, to be located on the backs of cards, be adequate for dual-density encoding. Airlines want the stripe on the face of the card. In the future, the Task Force plans to recommend a standard message format for authorizing credit. The standard is expected to meet the needs of all credit card issuers, not only bank cards. Adoption of cards that have data coded on them will lead to "zero-balance" credit cards, which must be verified electronically before each purchase.

Adoption of the standard would, of course, make it possible for a single terminal to provide the information required by a variety of credit card issuers. It would also enhance the probability of development of not only a national but an international credit card authorization system.

A system has also been patented which enables a merchant to place a customer's credit card in a sensor which generates a picture of the rightful card holder on a Picturephone of closed-circuit TV receiver display. The picture is kept in a microfilm file at a central location. If a picture is not desired, a description of distinguishing physical characteristics of the card holder may be sent, or other personal data that could be used to establish that the person presenting the card is the authorized user.

Banks and other issuers of credit cards are vitally interested in having these cards used only by authorized people. While banks are hopeful of eventually turning a handsome profit on their credit card operations, many are still marginal or losing ventures. (In part, this is a problem of the banks' own making--they voluntarily sent credit cards to people who turned out to be cheats and deadbeats.)

In this field, too, the Bell System is moving. Its credit card verification system is clearly more cumbersome than the automatic card-reading that will be possible if the proposed ABA credit card magnetic standard is adopted--but it's better for merchants than manual credit verification.

The Bell device is an adaptation of its automatic card dialer. When credit is to be verified, a card punched to make a call to a computer is inserted in the device. Once a link has been established, a card identifying the merchant is put in the machine, followed by a card that identifies the customer. If a purchase would exceed pre-determined credit limits, the merchant indicates the amount by pushing buttons on the device's Touch-Tone ® keyboard. The computer then makes a vocal response authorizing (or denying) the proposed transaction. In areas where Bell central offices are not equipped for Touch-Tone® calling, auxiliary equipment is available so that the system can be used with a regular dial telephone. The Bell device is also believed adaptable to magnetic tape encoding.

Rental is expected to come to about $5.00 per month for the device. If the computer is accessible through a Wide Area Telecommunications Service (WATS) lines, a charge is made only for the time the line actually is in use--expected to be less than one minute per call since the Bell automatic card-dialer takes only about one second to make the connection.

The range of business-related information that can be disseminated through a broadband system is limitless, particularly in a two-way system with rapid facsimile or fast printout at each terminal. Conceivably, the day might come when much white collar work is done at home, with the worker receiving the data he needs by cable and despatching the work he does similarly. Obviously, much business travel would be unnecessary if face-to-face conferences could be held on a Picturephone® circuit, with documents exchanged over facsimile circuits or displayed on the face of a cathode tube.

In the nearer-term future, however, it seems more likely that widerband capabilities will be most useful for the storage and retrieval of information. Essentially, this is treating a computer like a big filing cabinet to which users have immediate access. The computer's ability to manipulate data is not fully used, but the user of the data has access rapidly and at relatively low cost, in either verbal, display, or printed form.

Banks, obviously, have to keep tabs on many accounts and other transactions. Instant access by a branch to the full file of a customer in a central computer could expedite transactions. This file need not be printed out, in many cases. A cathode tube display of relevant data would often give a bank officer all the information he needs to decide whether to make a transaction or not.

RETAILING

In retailing, there should be substantial demand for use of broadband cable. Like banks, retailers are vitally interested in credit cards. At present, verification of credit card validity is often lax--the retailer knows that the credit card issuer will pay him for the goods even if they are 'paid for' with a lost or stolen card. As point-of-sale verification terminals become available, it seems reasonable to expect the credit card issuers to change their policy in this regard. If the credit card verifying terminal is combined with a charge slip imprinter, card validity could be checked automatically. Using a multiplexed cable channel and an open line, it is estimated that each retailer's credit card device could be checked automatically each 1.6 seconds. Insertion of an invalid card would be signaled to the retailer; if no signal was received the card would be presumed to be valid.

Multiplexed cable attached to the cash registers in stores could transmit sales data automatically to a computer--by individual items if necessary since the clerk would ring up the stock number of each product sold at the time of sale. (This is already done in some stores, where cash registers produce machine-readable tapes.) This gives management a chance to improve inventory control, and to check actual sales against projections very quickly.

The more glamorous use of cable in selling is, of course, display of goods on the TV screen at home, with the customer able to make a purchase by signalling the seller through his (or her) home communications console. Over-the-air broadcasting has clearly shown that TV is an effective sales tool. With a sophisticated two-way cable system, a customer could call a store, arrange for TV display of goods he is specifically interested in purchasing, and perhaps discuss the products with a salesperson. It

seems reasonable to imagine, however, that first efforts in CATV sales will involve dissemination of products chosen by the seller to whatever audience happens to be viewing a merchandising channel. Buyers would then order by telephone.

Eventually, catalogs of goods could be stored in computers or on ultra-microfiche at the CATV system's head-end, subscribers could arrange displays of pages of products they want to consider, and place their orders through the two-way system, which has a code for every subscriber. In the initial stages, however, it is probable that users of CATV systems who make purchases will be limited to products selected by the seller -- largely because the seller has to promote goods that carry a mark-up sufficient to defray his costs and leave a profit.

Such a two-way system simultaneously can control credit to CATV subscribers. When a bill is sufficiently overdue and still unpaid, the system's computer simply turns off the delinquent's response device, thereby making sure that no more purchases are made on that account until it is once again in good order. The computer can also refuse orders that would bring the buyer's account beyond the seller's credit limit for the household.

A major reorganization of the way retailing is done is implicit in the availability of a two-way CATV network. Successful selling via TV display will diminish the need for retail store space, since orders can be delivered directly from a warehouse. As cable networks expand, warehousing can be centralized and inventory more closely controlled, with periodic shipment of stock made to smaller areas serving specified localities. With the role of the retail store as a showcase diminished, the number of clerks required may decrease -- but there may be a significant rise in employment of demonstrators who show goods over TV channels.

Although the availability of a large number of channels would also make it economically and technically feasible for smaller merchants to use display over CATV (including neighborhood stores that could have their messages sent only to the locality they serve), it seems likely that remote buying will encourage purchases by brand name since the customer will not have a direct experience with the product. This implies that sales of tional brands will be most heavily promoted on CATV, including the house brands of big chains which have consumer acceptance and reputations for standing behind their products. Local stores selling national brands will be able to reach their customers, but affirmative customer response on many products may bear a direct relationship to the store's reputation for providing good service and for treating customers fairly when they have complaints.

METER READING

Remote reading of utility meters (electric, gas, and water) over a CATV channel has been touted as a possibly remunerative service that might be offered by a wired broadband communications service. In theory, this is correct and attractive, especially to CATV operators who currently charge their subscribers about $5.00 per month. If each utility were to pay $0.50 per month for its CATV meter-reading service, the resulting income would be a welcome increment.

It has been suggested that agreement by utilities to buy meter-reading services (which, at $0.50 per meter would cost them just about as much as their current expenditures to get data from the meter into machine-readable form) could interest CATV operators in wiring areas completely since the return from a fully wired area would be comparable to that now derived from a $5.00 charge to the 40 percent of homes connected that many CATV operators use as their basis for amortization. Meter-reading revenues alone would be $150 per month per 100 homes, and the 40 homes that would take TV service would provide an additional $200 months. To be sure, it would take a longer time for the meter-reading service alone to pay off -- but it seems likely that some people who would not otherwise subscribe to CATV service could be persuaded to do so "since the cable's already in the house." To be sure, the data from utility meters could as well be transmitted over a narrowband telephone line -- if the telephone company's price was right.

There are a number of other things that must be taken into consideration, however. At a fee of $0.50 per month, the utility makes no immediate saving -- though it probably would over a period since meter readers' pay is likely to rise. Water systems might lose money; they often read meters semiannually. The utility would gain in customer convenience and efficiency.

Each meter would be read on schedule, and meter-readers would not have to enter customers' homes. (Many utility meters are already located on an outside wall.) The utility meters now in use are, however, very long-lived, and any utility would think twice before putting a lot of money into replacing equipment that has many years of adequate service left in it.

It might well be that utilities could effect economies by turning to a different method of reading their existing meters -- something like identifying each meter with a sticker, then using a special microfilm camera to take a picture of the meter's dials and the identification. The microfilm, when developed, could be machine-read and the bills automatically processed. In CATV areas, utilities would find it more economical, when technically feasible, to add a shaft encoder to their existing equipment.

On the other hand, when meters are installed -- particularly in new communities that are being planned and built with two-way CATV -- routine installation of utility meters that can be read remotely would seem desirable.

This implies, of course, that meter-reading represents an area of relatively slow growth, not a bonanza. Similarly, when utilities replace worn-out meters in areas that are logical candidates for CATV penetration, or which already have systems that contemplate two-way operation, they might well be advised to use equipment that can be read remotely.

MARKET RESEARCH

Automatic market research represents another potential use for two-way CATV. At a fairly simple level, viewers at home could indicate a preference or opinion on a question by pressing a button on the TV set. CATV systems could conceivably serve as testing grounds for new entertainment programs, with viewers giving a 'good' or 'no good' signal.

On a technically more sophisticated level, TV receivers connected to cable systems could be so wired as to present a constant record of the channel they are tuned to at all times that the set is on. Such a system now is working in Santa Maria, California.

This system can be programmed to supply the names and addresses of all viewers who are watching a specified channel during a given time period. This would make it possible for market researchers to limit their follow-up efforts to those households which were watching a test program or commercial, for example. Consequently, the total cost of this research would be greatly reduced.

OTHER USES

Consumer uses: Federal sponsorship of data banks stocked with information relevant to consumers has been proposed. Indeed, the Federal Trade Commission is currently conducting a study, undertaken at President Nixon's request, of the possibility of establishing a nationwide consumer information data bank. Currently, the study is limited to determine the requirements for such a data bank. Sen. Philip A. Hart (D., Mich.) and consumer advocate Ralph Nader (as well as others) have also advanced this proposal. To be of maximum use to consumers, it will have to be accessible to them. Access can be had through telephone lines, of course, but it would very likely be preferable to have the data bank's computer provide written data in response to consumer queries. If, or when, consumer data bank programs become available, CATV systems could obtain them and provide this information to their subscribers through their own computers, presumably on a fee-for-service basis.

Reservations: Computerized reservation services are already in use by many airlines, car rental agencies, and hotel chains. But they are accessible only by making a telephone call to one of the company's reservation desks. With widespread use of point-of-sale terminal devices, it would be possible for travel agents, for example, to obtain for their customers immediate information on seating availability for air travel, rooms and their rates for hotel patrons, and vehicle availability for car renters. Required data could be displayed automatically on a cathode tube, and reservations made on an associated keyboard.

Real Estate: In real estate businesses, even smaller companies would find it useful to be able to generate, from their own or remote computers, pictures of the properties they currently offer for sale, maps showing the location of each, and a print-out of descriptive material.

Insurance: Companies could arrange to give their agents access to all policy information at the touch of a few buttons. This would be helpful in settling claims quickly, in bringing accounts up to date, and in checking on the insurance planning status of customers and prospects. If a system of no-fault auto insurance is enacted, a central information bank accessible to insurance agents may be a necessity.

CABLE'S COMPETITORS

Advancing technology will certainly have an impact on purveyors of broadband communications services. In this area, it is impossible to approach the Bell System with anything other than the highest respect, and to assume that it will continue to keep pace in those communications fields in which it does not lead. But the future of cable will also be affected if new methods of broadcasting that provide sharply increased spectrum capacity are successfully developed. Obviously, the incentive to lay cable (FCC says a "working figure" for cost is $4,000 per mile) is diminished if the number of TV channels available to the public can be increased by cheaper broadcast methods. Since commercial uses of cable depend heavily on two-way communication, use of new broadcast methods would tend to keep merchants and others dependent on telephone company facilities, which are (or will be) adequate for most commercial transactions.

The fact is that the Bell System (and other telephone companies) have lots of problems other than broadband communications. Under current FCC policies, telephone companies are barred from owning CATV companies in those areas where they operate as telephone utilities, and they must make their poles available for stringing CATV lines at reasonable cost. This, obviously, encourages independent CATV systems. More significant, perhaps, is the fact that in many parts of the country the telephone utility is hard pressed to upgrade its existing services, and to make them fully satisfactory to present and anticipated subscribers.

As long ago as 1968, the Bell System publicly recognized that huge demands were going to be made on it for new equipment, and that usage of its lines was going to rise very sharply. At that time, it projected

that by 1980 there would be an increase of 70 percent (70 million) in the number of telephones in use. It expected a tripling of long distance calls from about 5 billion a year to 15 billion a year, and a tenfold increase in the number of overseas calls made form the U.S., from 12 million to 120 million. The typical day would bring 500 million calls in 1980, Bell said, up from 300 million in 1968. Bell added: "By 1980, as much information may be exchanged by data transmission as by voice communications." Actually, this point has already been reached. Bell also asserted that the 1968 "interstate network represents only about 15 percent of the plant-in-service that may be needed" as the 1980's begin.

Evidence to support this view is readily visible. The Touch-Tone ® telephone is really a 12-button device that gives access to a computer -- and hence to all the data that can be stored in a computer. In May 1967, the Bell System's public relations department asserted that "your telephone may be able to do almost anything you want it to by the year 2000." Today, this type of telephone is being sold to the public as "the fastest thing since the wheel", and its promise of future delights goes untrumpeted. Since Touch-Tone ® telephones cost more, one can not help but admire a business trategy that seems to be succeeding in persuading the public to pay in advance for the use of a device that will, for most users, confer significant new benefits only at some unspecified future date -- and even then almost certainly at an additional charge for each service.

To be sure, some of the potential of Touch-Tone ® telephones is being exploited. Devices are available which enable telephone users to 'dial' frequently called numbers automatically. A variant on this card-dialing system is in use for inventory control and stock replenishment systems.

So far, the CATV industry has spawned a number of technical advances, and more can be expected as demand for cable-related devices increases. The needs of cable have been fairly simple up to now, so that the economic incentive to develop two-way response capacity has been small. Businessmen have been reluctant to try to market equipment for which there is hardly any demand. This will surely change as wired broadband systems become more widespread and as use of its two-way capabilities becomes a real, rather than a potential, profitmaker.

Cable systems that exist today are small markets, and the suppliers of equipment have tended to be small as well. In common with most other parts of the electronics industry, supply of basic CATV components is a business that can be entered fairly readily. The Bell System has an in-house monopoly supplier, Western Electric, which also has considerable expertise in cable-type communications, and Bell Labs as a powerful research arm. Experience so far with cable communications implies that (1) the Bell System will continue to use Western Electric and (2) that existing suppliers of cable equipment to CATV operators will be joined by others as demand expands. Some of these small suppliers will be technologically innovative. Thus, prospects are good that technical advances will leapfrog from Bell to the independents and vice versa. A long-range cost advantage may lie with CATV's, since their suppliers will be able to import equipment whereas Bell is tied to Western Electric.

It should be borne in mind that the Bell System operates on a vast scale. When it adopts a design for equipment, this design tends to remain basically stable for many years. Installation of equipment costs vast sums. Cable installations also have to be paid for -- but a small

city or neighborhood can be wired for a total cost far smaller than setting up a new long-distance cable from Boston to Miami. Thus, CATV operations may be able to avail themselves of tehcnically advanced equipment more rapidly than the Bell System.

New methods of broadcast transmission promise to become available in time. FCC has already authorized over-the-air Community Antenna Relay Systems, which use microwave radio, but their use is limited. Short-haul, microwave, Local Distribution Systems, the FCC says, could be cheaper than laying CATV trunks. Development of these technologies, and others, poses a definite threat to the future development of CATVs that are primarily oriented to supplying entertainment signals to subscribers on a one-to-many basis.

Another development, the Amplitude Modulated Link, is said to be useful for relaying off-the-air signals from the site of the AML transmitter to a CATV head-end.

FCC has also approved another system said to be useful for transmitting CATV signals. Although called a 'quasi-laser', it is actually based on use of the infra-red portion of the spectrum. It is claimed that a single quasi-laser transmitter can carry up to 18 TV channels on a single beam, and provide service covering a 15-mile radius.

Still under development is the "FM laser", invented by Dr. William J. Thaler, head of the physics department of Georgetown University and originator of over-the-horizon radar. FM laser is said to be capable of doing as much as microwave, to be substantially cheaper, and to accomplish this within a very narrow beam.

Dr. Thaler says that at present he is operating a 1.2 mile link transmitting"black-and-white color TV information." In the laboratory, he has succeeded in transmitting color video information. And, he adds, "we're just about on the verge of improving the modulator to the point where we should be able to multiplex color TV channels over this system, hopefully up to something like 15 channels."

Dr. Thaler believes that a major advantage of his system is that it is frequency modulated, thereby avoiding interference from amplitude-modulated atmosphere noise. Still in the works at Dr. Thaler's laboratories is another device that uses electro-optics to produce frequency-modulated laser light. In the laboratory this device is already "in excess of a Gigaherz", but its full development is obviously still some time away.

The Bell System will not be standing idly by while independent CATV and microwave systems pre-empt its long distance specialized traffic. Bell was a pioneer in coaxial cable; it began to study coaxial structure in the 1920's and applied for a patent on coaxial cable in 1929. The first Bell long distance coaxial system was demonstrated in 1936, TV was transmitted over coaxial cable in 1937, and Bell's first commercial coaxial service (Capacity, 480 circuits) was introduced in 1941. Currently, Bell is installing a long distance cable system it calls L-4, estimated to cost $2 per circuit mile, with the capability of carrying some 32,000 voice messages simultaneously. This cable's successor -- L-5 -- is being worked on. Estimated to be capable of carrying over 90,000 voice messages, it could cost as little as $1 per circuit mile. Furthermore, Bell says that L-4 cable can be upgraded with L-5 electronics. In addition, Bell is working on its planned high-capacity cable for transmission of digital

messages, including computer data and Picturephone® signals.

As the Bell System sees it, starting around 1980, it is likely that circular waveguides--with a digital message capacity of over 250,000 circuits--will be installed when new lines are needed in areas where usage is heavy. In the more distant future is the possibility of using laser beams as message carriers--and one of these optical channels would be able to carry more than 10 million voice channels.

Bell's plans for digital data transmission imply that it expects to keep highly competitive in this field. At present, Bell is using a system it calls T-1, a short-haul (less than 50 miles) pulse-code modulated system. It has a field trial of a T-2 system under way at Willow Grove, Pa. The T-2 system is a 400-mile system. By 1975, Bell expects to have a T-5 system capable of spanning the continent.

Bell's Picturephone® system, which currently uses a bandwidth of one MHz, is currently offered on a very limited basis, and it is finding few takers. At present, the resolution it offers on its display tube is inadequate for typewriter type. But, interfaced to a computer, the Bell device can provide display of a great deal of business-related information, and it permits the user to manipulate the data. A self-contained, non-Bell system could do as much, and a two-way cable to a central computer could provide not only data relevant to a particular business, but access to a variety of other materials as well.

For the present, a moderately skeptical view of Bell's expansion plans must be taken. Complaints about ordinary telephone service are frequent both for Bell and independent companies. Late in April, 1971, the New York State Public Service Commission denied a New York Telephone Co. application to set up an experimental Picturephone® service for intercom

use only in lower Manhattan. The modest set-up envisaged by the utility would have required 10 employees for installation and servicing.

But the PSC denied it, saying that "any diversion of company assets and resources to other than essential services, no matter how minuscule, is contrary to the Commission's objectives and policies." The regulatory body agreed to allow the utility to re-submit its application--"whenever the level of basic telephone service has improved sufficiently to permit favorable consideration of this new and important service offering."

Nevertheless, it must also be borne in mind that for the purposes of most business-oriented users of communications, the telephone company's network provides adequate facilities. To be sure, some users of existing data lines pay a penalty because they can not run their computers and associated equipment at optimal speed and must suffer the expense of modulator-demodulator equipment. Bell points out that when it offered a service capable of 50,000 bits per second, "people didn't beat our doors down". The volume of traffic is such that it can be accomodated by telephone lines, and move fast enough to keep users fairly well satisfied. Since the Bell System has a substantial leg up in creating a wider-band network, it may be able to satisfy its customers fully before competitive broadband networks are built.

Nevertheless, data users seem eager to grasp any alternative to telephone-grade lines. Remote batch equipment--a fast growing area--operates optimally at about 12,000 words per minute. But limitations imposed by the availability of service from telephone companies force these devices to work at speeds of about 3,000 words a minute.

A two-way cable network in a small area could very well move fast enough to have local facilities available before the Bell System and Western Union do. Certainly, such a system could be in operation sooner than a microwave link network, since it is estimated that three to five years will elapse between May 1971, when the FCC authorized such specialized communications networks, and the time national data transmission service can be offered.

Bell's role at present seems to be to sit tight and improve its service. Within a few years, it expects to have ample,technically excellent, data-carrying networks available to volume users. If FCC requires cable operators to provide two-way communication capacity, Bell might elect to have these systems interface with their long-lines data networks. Independent specialized data networks could well be inclined to use CATV facilities to carry their traffic from their point of origin to the microwave transmitter and from the receiver to their destination, although one such network has proposed using CATV facilities only when it is impossible to provide direct network-to-addressee links by optical laser transmission.

In all likelihood, the Bell System would be happy to devote itself to handling the traffic generated by large-volume users of data. Small users--individual credit card terminals in stores and restaurants, for example--can be serviced adequately by ordinary telephone lines, although probably at higher cost than through an open-channel automatically scanned CATV link.

OTHER ISSUES

Initial Congressional response to future developments in the use of two-way cable could well be hostile. When an entrepreneur obtained the TV and other rights to a heavyweight championship fight so that it was visible only in the arena or over closed-circuit TV, complaints were vociferous. A bill co-sponsored by 32 members of the House and several members of the Senate was introduced to force sports events to be shown on free, home TV by banning the use of closed-circuit TV whenever a sports event is of sufficient public interest for radio or TV stations to want to broadcast the event.

Two-way cable communication, with sales made direct from the TV set, will have a major impact on business. To the extent that it has an adverse effect on small business, it is all but certain that efforts will be made in Congress to impose restrictions on the use of cable systems for consumer purchases.

The extent to which cable entrepreneurs will be allowed to engage in non-communications activities has yet to be settled. The FCC has already ruled that common carriers with annual revenues of $1 million or more can provide data processing services only through affiliates that are completely separated from the parent company. General adoption of the principle underlying this FCC rule could put serious restrictions on the diversification permissible to cable companies.

In turn, this could be an inhibiting factor for expansion of the cable systems or networks. Costs to consumers might well be higher if cable system operators are allowed to do nothing more by way of business-related activity than supply a channel to an advertiser or other user.

PRIVACY

The need for privacy in financial transactions carried over a cable or other broadband system can hardly be overstressed. In one way, this may be a persuasive argument in favor of cable rather than over-the-air broadband links, which are more susceptible to unperceived interception. For true security and privacy in an over-the-air communication, a scrambler must be used by the originator of a message and an unscrambler by the addressee. This is costly.

Using a CATV system, it is possible to design a coding method that should make sure that only the addressee gets a specific message--the print-out of his bank statement, for example. But the full development of the multiple-address, non-switched broadband communications devices that will make possible such private communications i still to come.

When CATV is used for financial transactions, steps will have to be taken not only to insure privacy, but to preclude unauthorized persons from gaining access to computer data so they can make improper transfers of funds. Some computer technicians believe that "you can get all the privacy you're willing to pay for," and this may well be the case. Right now, most people get privacy they believe adequate for their confidential transactions by using the mails.

Nevertheless, the need for privacy, security, and absolute accuracy in the transmission of transactions argue that all of the devices used in electronic data transfer--both from the home and into the home--will have to be thoroughly reliable and of high quality. This implies greater cost than is now experienced in buying entertainment-grade electronics. Once business operations are integrated with a communications system, failures

become very costly, and highly reliable equipment is essential to the functioning of the whole.

The need for privacy extends far beyond financial transactions in any society that is rushing headlong toward computer assistance in such quantity that some people think in terms of computer domination. The National Science Foundation in April 1971 funded a two-year study for ground rules that will protect privacy in the computer age. The primary objective of the study, NSF says, is to find an accomodation between the need for confidentiality of information and the desire to gain greatest possible usefulness from computer technology and data bases. This may result in drafting legislation aimed at protecting individual privacy without sacrificing the social benefits of computer technology. The study will also extend to the technological or administrative safeguards that will have to be adopted to provide maximum confidentiality and to minimize the possibility of improper intrusion, but this is expected to be done in the second phase of the study.